NUI Galway
OÉ Gaillimh

# ***Autumn Examinations 2017/ 2018***

| | |
|---|---|
| **Exam Code(s)** | 4BCT1 |
| **Exam(s)** | 4 th Year Examination Computing Science and IT |
| **Module Code(s)** | CT421 |
| **Module(s)** | Artificial Intelligence |
| Paper No. | 1 |
| Repeat Paper | No |
| External Examiner(s) | Professor Jacob Howe |
| Internal Examiner(s) | Professor Michael Madden |
| | *Dr. Finlay Smith |

**Instructions:** Answer 2 questions from each section. All questions will be marked equally. Use a separate answer book for each section. Duration 2

| | |
|---|---|
| **Duration** | 2 hours |
| **No. of Pages** | 2 |
| **Discipline(s)** | IT |
| **Course Co-ordinator(s)** | |

**Requirements**: None

**PTO**

## Section A

1.
   a. Describe how Fuzzy Logic can be used to control a physical system. Your description should include details of each of the steps involved. (9 marks)
   b. How does Fuzzy Logic differ from conventional 'crisp' logic? What are the advantages of Fuzzy Logic over crisp logic? (8 marks)
   c. How is uncertainty handled in Fuzzy Logic? Give an example of when this would be useful. (8 marks)

2.
   a. What are the limitations of Quantitative representation? How does Qualitative representation overcome these limitations? (10 marks)
   b. In Mycin type systems, if the CF for a conclusion X was deduced to be both 0.8 and -0.3, what would be the combined CF? (Show your workings) (9 marks)
   c. Give 6 different ways that uncertainty can be introduced into a system. (6 marks)

3.
   a. What are the differences between the search space in AI search and conventional search? (8 marks)
   b. Describe how the combination of both forward chaining and backwards chaining could be used to simplify a search to see if a given person is a descendant of William Shakespeare. What assumptions would be made when undertaking the search? (10 marks)
   c. Describe Depth First Search with Iterative Deepening. How efficient is it compared to Depth First Search and Breadth First search? (7 marks)

## Section B

4.

a. What do you understand by a 'greedy searcher?' (7 marks)
b. Suppose that available coins for change are 50, 20, 10 and 1, and that the least number of coins is preferred. Explain what a greedy searcher will do if the change needed is 60, where a greedy searcher always selects the biggest denomination that will work. (9 marks)
c. Suppose that available coins for change are now 25, 15, 1, and that the least number of coins is still preferred. Explain why a greedy searcher will not perform optimally if the change needed is 30, where once again a greedy searcher always selects the biggest denomination that will work. (9 marks)

5.

a. In the context of genetic algorithms, explain what is meant by the term 'mutation' (5 marks)
b. A software bot (like Mitchell's Robby) is to be developed for collecting cans in a 10 by 10 two-dimensional array. A cell of this array can be empty or contain a can. In terms of context, a bot can see the contents of the current cell, and the contents of one cell north, south, east and west. In terms of actions, a bot can: Move one cell north, south, east, west, move one step randomly (north, south, east, or west), pick up a can in the current cell, or do nothing. A reward should be given if the bot picks up a can in the current cell. However, a fine should be applied if the bot's action is to pick up a can and there is in fact no can in the cell. Discuss the development of a suitable genetic algorithm for this bot (12 marks)
c. Do genetic algorithms always find a solution? (8 marks)

6. "Systems like Siri and Alexa represent the current state of Artificial Intelligence (AI), from the perspective of personal assistants. Alphazero represents the more specialised area of game-playing AI. " Discuss this statement under the following three headings: Current state of AI-based assistants (7 marks), current state of game-playing AI (10 marks), future trends in EITHER AI personal assistants OR in game-playing AI (8 marks)